



UWS Academic Portal

Creating a smart rural economy through smart specialisation

Talbot, Stephen

Published in:
Local Economy

DOI:
[10.1177/0269094216678601](https://doi.org/10.1177/0269094216678601)

Published: 01/12/2016

Document Version
Peer reviewed version

[Link to publication on the UWS Academic Portal](#)

Citation for published version (APA):

Talbot, S. (2016). Creating a smart rural economy through smart specialisation: the micro-sphere model. *Local Economy*, 31(8), 892-919. <https://doi.org/10.1177/0269094216678601>

General rights

Copyright and moral rights for the publications made accessible in the UWS Academic Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

If you believe that this document breaches copyright please contact pure@uws.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

Title

Creating a smart rural economy through smart specialisation: the micro-sphere model

Abstract

The failure of most developed western economies to return to the rates of economic growth enjoyed in earlier times has raised the spectre of secular stagnation first identified by Hansen in the 1930s. Central to secular stagnation is the complex link between capital investment and innovation, prompting fears that the recent collapse in investment is both a cause and an effect of the so-called 'end of innovation'. The emergence of so-called zombie companies suggests a curtailment of creative destruction. The paper looks to the smart specialisation agenda and demand-led strategies for innovation as a means of removing innovation activity from reliance on large-scale top-down capital investment, instead shifting the focus to the role of the entrepreneur in the innovation and growth process. Key features of smart specialisation are used to underpin the construction of a conceptual model (the micro-sphere) that presents policymakers with a framework to reconnect with the entrepreneur to boost innovation and growth at the level of the region. The model frames the *micro-sphere* within which smart specialisation takes place, and how this can encourage innovation among small non-growth rural firms. Influenced by New Industrial Policy and the social geographies underpinning reflexive capitalism, the model builds on the entrepreneurial discovery process inherent in smart specialisation. The model provides policymakers with a guide to operationalise a smart specialisation strategy. Finally, the model is tested in a case study based on the priorities of an economic strategy of a rural region of Scotland.

Key words:

Smart specialisation, reflexive capitalism, secular stagnation, economic growth, rural economy, entrepreneurial discovery process, innovation.

Author

Steve Talbot

Director of Business Intelligence, Crichton Institute, Crichton Campus, Dumfries, DG1 4FD

Tel: 01387 345 376

Email: steve.talbot@uws.ac.uk

Introduction

The aim of this paper is to create a model of the smart specialisation process that can be used by regional policymakers to enable them to add a demand-led strand to their policies for economic development. That is, a policy approach that involves “letting and helping the regional economy to discover new activities with strong potential” (Foray 2009:3). While drawing on a number of related themes from different areas of research, the focus of the paper is on the rationale for policymakers to adopt a demand-led approach rather than a critical analysis of the literature.

Exploring some of the central ideas surrounding regional innovation system (RIS) theory, the paper looks to develop a practical micro-level method for strengthening the productive dynamics of rural economies as an aid economic growth. While RIS-theory has underpinned regional innovation policies for over twenty years (OECD 2010, 2011a), the operationalising of RIS theory remains relatively underdeveloped (Edquist 2005; Woolthuis, Lankhuizen, and Gilsing 2005; Georghiou et. al. 2014). The paper examines the rationale for introducing a policy for a regional innovation system for smart specialisation (RIS3) and uses a case study to demonstrate the applicability of such a model in a rural region of Scotland. Despite issues of remoteness and scale, the RIS3 approach offers rural regions a policy framework within which they are able to identify, and build on, areas of competitive advantage to achieve significant improvements in productivity (Foray 2014). RIS3 identifies the entrepreneur as the driver of economic growth by means of the entrepreneurial discovery process (Audretsch and Thurik 2002; Foray 2012). Foray describes the entrepreneurial discovery process as that which “precedes the innovation stage and consists of the exploration and opening up of a new domain of opportunities (technological and market), potentially rich in numerous innovations that will subsequently occur” (Foray 2014:495). In addition to the producer, the discovery process involves the ‘user’ in any discovery and is therefore deemed a ‘demand-led’ approach to innovation.

The contribution of the paper is the design of a reflexive-capitalism-based model as the vehicle for entrepreneurial discovery: where users and producers engage in sharing and networking of information rather than embroil in market-based competition. Creating such a ‘reflexive-capitalism environment’ would make it more likely that rural regions would more readily engage in the entrepreneurial discovery process through identifying, and building on, their competitive strengths (MacLeod 2000).

The contention of the paper is that such a model offers a pathway round many of the obstacles and headwinds that Gordon (2015) identifies as contributing to so-called secular stagnation, and provides remote regions with the potential for identifying and exploiting their competitive advantages to achieve growth (McCann and Ortega Argiles 2013). The model addresses issues surrounding the operationalising of RIS3 as it moves from theory to practice (Georghiou et. al. 2014; Svare and Haugen Gausdal 2015) and is tested against the strategic priorities of a rural region of Scotland (Dumfries and Galloway), examining its potential to exploit latent regional competitive advantage in the emerging sharing economy (Fellander, Ingram and Teigland 2015). The UK's growing sharing economy is "a socio-economic ecosystem built around the sharing of human, physical and intellectual resources" (Nesta 2014: 10).

The paper is organised as follows: a brief look at some of the concerns underlying investment, innovation and stagnant productivity growth; this is followed by a look at the role of the entrepreneur in regional development; the paper then looks at the context within which entrepreneurship and the region may be understood; it then pulls together a number of strands from the literature to build a conceptual model that facilitates smart specialisation, finally a case study is presented where the model is tested against the economic strategy of a rural region of Scotland.

Concern around productivity growth

We begin with a brief look at the issue of productivity and the re-emergence of the entrepreneur as a driver of innovation and growth. Concerns over the cause of poor productivity growth have been around since the 1930s when Alvin Hansen coined the term secular stagnation to explain the intricate role innovation plays in stimulating capital expenditure and thereby helping to attain 'reasonably full employment' (Hansen, 1939). While Hansen wrote at a time of declining US population growth and the ending of US territorial expansion, some see disturbing parallels with today's low rates of productivity growth and a reluctance of firms to undertake capital investment. For example, using US data Gordon (2015) identifies a series of supply-side constraints that encourage lower rates of labour force participation; curtails capital formation by large firms and which culminates in slower productivity growth. To support his thesis that a series of 'head winds' are holding back the US (and many other developed countries) Gordon notes that "[G]rowth in real per capita income over the past ten years has been only 0.6 per cent per year; less than one-third of the 2.1 per cent

achieved from 1890 to 2007. The ratio of net investment to the capital stock has declined over the past five years to 1.0 percent, less than one-third of the average ratio achieved between 1950 and 2007” (Gordon 2015:58). Interestingly, Hansen doubted the potential of a permissive monetary policy to provide the environment necessary to boost real investment. Today, doubts surround the impact of extreme monetary policies of quantitative easing and (in some jurisdictions) negative interest rates that have swept the developed world since 2007/08 (Martin and Milas 2012; Riley et. al. 2015). Worryingly, there appears to have emerged a structural surplus of saving over investment in the corporate sector in the UK and other G6 countries prior to the Great Recession, hinting that investment avenues were becoming scarce prior to the crash (IMF 2015).

UK gross fixed capital formation (GFCF) tends to be the component that contributes most to variations in aggregate GDP. It was particularly volatile during the last recession, accounting for almost half of the 6.8 percentage point decline in output between 2008 and 2009. But perhaps more importantly, there has been a significant fall in investment intensity as measured by the share of profits re-invested. Investment intensity averaged 54 per cent between 1997 and 2003 but has fallen to around 42 per cent since then. According to ONS, “[t]he most recent fall in investment intensity – between Quarter 3 2015 and Quarter 1 2016 – reflects the larger falls in business investment than in estimated profits over this period” (ONS 2016a:14). This fall may indicate deeper underlying changes in business models and increasing risk aversion. Data on the private non-financial corporation (PNFC) sector show it to have been a net lender, suggesting a lack of willingness to invest on behalf of the private sector (ONS 2016c). Interestingly, quantitative easing and its accompanying historically low interest rates appear to have encouraged innovations in financial engineering which have supported the spread of so-called ‘financialisation’ to the detriment of the real economy (Epstein, 2006; Turner, 2012; Stiglitz, 2012).

According to Epstein (2006) increasing financialisation is one of three over-lapping trends that have emerged over the past two decades (the other two being neo-liberalism and globalisation). Financialisation has seen financial engineering create increasingly sophisticated financial products that divert resources from the real economy thereby limiting non-financial investment, lowering labour productivity and hindering growth of output (Kapetanios et. al. 2012; Stiglitz 2012; Hudson 2015). Furthermore, constraints on government

spending weaken the impact of fiscal policy; particularly when much of that spending is devoted to tackling some of the headwinds identified by Gordon e.g. increasing welfare (consumption) spending relative to infrastructure (investment) spending.

The slow pace of economic recovery from a recession deeper than that of the 1930s lends support to some aspects of the secular stagnation hypothesis and that the world has entered a 'new normal' of low growth (Cato Institute 2013; IMF 2016). This lack of recovery together with the limited room for further manoeuvre using traditional monetary and fiscal policies has led the OECD and EU to call for a more intelligent approach to tackling long-standing structural problems that contribute to low productivity growth. The core of this approach is to include smart specialisation within policy frameworks (OECD 2013; EU 2014). According to OECD, "[s]mart specialisation, both as an economic concept and a policy framework, provides a novel avenue to pursue the dual objectives of fiscal constraint and investment in longer-term growth potential in a context of rapid technological change and globalisation" (OECD 2013:22). Smart specialisation returns the entrepreneur to centre stage in addressing the crisis in innovation, particularly in helping reveal so-called hidden innovation: "'[H]idden innovation' means that innovative activities being undertaken in such 'low-tech' sectors also require support that is likely to be of a different nature and form (e.g. building internal capabilities of firms, assistance in adopting new process technologies or 'out-sourcing' product development) than the strong emphasis on funding support provided to R&D intensive sectors" (Technopolis 2012:13). It is this 'hidden' innovation that the micro-sphere model, designed around smart specialisation, seeks to reveal; particularly in a rural setting where talent has fewer avenues to shine. In the model, the entrepreneur's search for 'hidden' innovation becomes a key driver of growth; with each region's unique factor endowments combined in a manner to suit emerging opportunities. Placing the entrepreneur at the centre of the analysis of productivity differs markedly from traditional explanations of regional growth (Porter 2003; Henrekson 2005; Dannreuther 2009), where disparities in regional growth rates are based on drivers such as scale economies, industry clusters and natural resources. The prospect now is one where low growth regions are able to shape their own destiny by influencing factors under their control, with entrepreneurship becoming "a mechanism through which temporal and spatial inefficiencies in an economy are discovered and mitigated" (Shane and Venkataraman 2000:219). In the next section we highlight how micro-aspects of spatial economic growth are

contained in a demand-led approach to innovation policy which places the entrepreneur at the centre of regional economic development.

Reconnecting with the entrepreneur in regional development

The traditional neoclassical supply-side model assumes perfect factor mobility, meaning that persistent disparities in regional growth rates are largely due to regional differences in levels of total factor productivity. Regions with lower levels of total factor productivity find it more difficult to manage technological change as diffusion of new technology will be slower thereby leading to the emergence of a technology-gap. Closing this gap becomes a major policy aim to be achieved through knowledge transfer programmes. According to Armstrong and Taylor, the main reason behind continuing regional divergence “is that some regions are more able to generate their own technical change...while “[l]ess well-endowed regions have no alternative but to rely on exogenously embodied technology since they are not capable of producing their own” (Armstrong and Taylor 2000:87). Regional differences in rates of diffusion do not “result in a tidy equilibrium growth path, as the neo-classical model assumes... or in convergence of growth rates” (Cheshire and Malecki 2004:251). Thus, an important endogenous factor (knowledge diffusion) needs to be addressed: in addition to attracting and retaining labour and capital, lagging regions need to make these factors more productive through successful diffusion of new technology. Deficiencies in the neo-classical supply-side approach, which is based on resource-use optimisation in location or natural resource endowment to achieve comparative advantage, have proved resistant to regional policies (Smith 2000). Meanwhile, demand-side models of regional growth, such as Kaldor’s, also reveal the important role of endogenous factors. These models, while based on exogenous demand, rely on increasing returns to scale and in creating a virtuous cycle between growth of output and growth of productivity (the Verdoorn relationship). This means that there is a strong endogenous element reinforcing external demand for the region’s output: labour productivity and technical progress in part drive product quality improvements that in turn lead to more demand (growth). Successful regions will produce high quality, non-price sensitive output and will remain diverged from regions that are not able to manage their endogenous factors as effectively: success breeds success. While supply side and demand-side models respectively rely on factors such as external technology and external demand for sources of growth, each acknowledges the importance of endogenous factors; factors such as knowledge diffusion and labour productivity & technical progress (respectively). Each model relies on a top-down approach employing spatial

factors at various levels of analysis to identify exogenous determinants of long-term economic growth and the extent to which these are amenable to policy interventions such as targeting market failure or promoting R&D tax breaks (OECD 2011b).

However, policies based on top-down models have failed in their aim of convergence between regions, particularly in the UK where a relative disparity among the regions is a permanent feature of the economic landscape (Hudson 2007; Boddy et al 2015; Mason and Brown 2012; Brown and Mason 2013). An example of continuing regional divergence is the persistence of an under-performing tail within the firm-productivity-distribution of a region acting as a significant drag on a region's growth prospects (Harris 2001). Top-down policies have been unsuccessful in eliminating such tails or in closing gaps in regional performance. According to Harris "such models are by their nature too aggregate for empirical testing, especially in their ability to discriminate between which factors are most important in determining productivity, competitiveness, and growth, as well as which are exogenous to the region and therefore amenable to policy intervention" (Harris, 2008:20). Interventions based on sector and/or market failure are an aggregate response to issues that are essentially firm-based in nature and such interventions have a poor record of success (OECD 2001; What Works Centre for Local Economic Growth 2014).

Managing externalities

The ability of firms to successfully manage and exploit external tacit knowledge is a key feature of the type of endogeneity present in both supply-side and demand-side models (that is, how knowledge is diffused or utilized to boost labour productivity). The capture, diffusion and economic value, of external tacit knowledge, depend on the economies of scale and scope within regional industries. We look briefly at these economies to identify the types of knowledge spillover that drive the proposed micro-sphere model. Looking firstly at knowledge spillovers driven by economies of scale, we revisit the neoclassical supply-side model and the Marshall-Arrow-Romer (MAR) framework. Under MAR analysis spillovers are the result of two types of externality: pecuniary and non-pecuniary. The former is associated with rents to be gained within the vertical buyer-seller relationship where quality improvements in the shared labour pool and supply of intermediate goods are not appropriately priced (Koo 2005). The prospect of rents attracts firms to the location and creating a spatial agglomeration. Harris (2008) identified spatial agglomeration as being associated with a higher

likelihood of exporting and thus a good indicator of a higher productivity region. The latter form of externality involves knowledge-based spillovers that are not attached to vertical linkages but are generated when firms share a pool of knowledge. This form of externality is seen as non-pecuniary, arising out of co-location of firms within the same industry (horizontal). Thus, in the MAR framework, vertical externalities involve market-based activities while horizontal externalities involve non-market co-location. While MAR-type externalities lead to specialisation, other forms of externalities can produce spillovers that produce heterogeneity. Based on economies of scope, Jacobian spillovers involve a range of diverse firms and industries attracted by inter-industry spillovers. Successful urban areas attract a range of heterogeneous firms which re-enforces the attraction for other firms. Jacobian-type spillovers tend not to occur in remote and rural areas (Glaeser et al. 2001). Boddy et al. (2005) found that within the UK being on the 'periphery' had a significant impact on a region's relative productivity. Remote regions have few of the advantages in terms of scale and/or scope necessary to achieve the agglomeration gains from localized externalities embodied in MAR-type or Jacobian-type spillovers (Smith 2000; Plumridge et al. 2008; Harris and Li 2005). This is part of the wider debate around the economics and impact of localized knowledge spillovers (Breschi and Lissoni 2001) but we shall see later that the proposed micro-sphere model helps to generate Jacobian-type of spillovers.

Regional innovation systems theory on the other hand explores how the region (as a whole) manages and exploits exogenous tacit knowledge (spillovers), rather than the activities of individual firms. An innovation systems approach looks beyond the narrow firm-based gains to knowledge spillovers that drive agglomeration and specialisation. Rather than assessing how external knowledge spillovers affect individual firms, it focuses on the effectiveness of the wider regional environment to generate synergies; with the system being composed of "economic (e.g. firms, private research institutes), institutional (e.g. education institutions, government departments, chambers of commerce), technological (e.g. technology transfer agencies) and social sub-systems, which interact continuously with each other and operate as a system" (Cooke 1997:362). Key to the knowledge diffusion process is social networks and building social capital which improves localized knowledge spillovers (Feldman 1999). The focus is thus on the relationships and flows between the various actors and parts of the innovation system" (Cooke 1997:362). Regional innovation systems theory aims "at improving general framework conditions and capabilities (good universities, human capital, intellectual property rights, research and ICT infrastructure, competition and openness, and so on" (Foray 2014:3). The

Triple Helix approach is an example of such a regional innovation system that identifies a number of key sub-systems: government, industry and universities (Etzkowitz and Leydesdorff 2000). So too are other 'eco-sphere'-type frameworks that look to identify the dynamics that underpin regional performance (Asheim and Gertler 2005; Lundvall 2010; Asheim, Smith, Oughton 2011; Mason and Brown 2013a). However, while a functioning eco-sphere is a necessary condition for a dynamic and growing economy, it is insufficient in itself due to leaving large swathes of the economy un-touched i.e. areas and communities where talent and ideas remain latent and never join an eco-sphere (OECD 2014; Nambisan and Baron 2013; Mason and Brown 2013b; Webber et al 2007). With few mechanisms to articulate latent potential, these areas remain relatively depressed and dependent on continuing rounds of externally funded regeneration 'initiatives' and innovation and entrepreneurship programmes.

In contrast, a regional innovation system for smart specialisation (RIS3) approach offers a means by which such latent talent can shine through. It involves policymakers identifying a "selection of desirable areas for intervention" involving "some technologies, fields, sub-systems that could be favoured". Foray calls this adopting a 'non-neutral policy stance' because it looks to favour identified sub-sectors of an industry rather than applying horizontally across the whole industry in a neutral (i.e. non-selective) fashion. Thus, instead of encouraging horizontal (sector-wide) initiatives that support value chain and/or value networking, policymakers should seek to encourage vertical networking between sectors and sub-sectors (Foray 2009:3). Policymakers should focus on two main activities: non-neutral targeting of specific sub-sectors of the local economy, and helping to foster and develop vertical connections between them (very much like those associated with user-producer relationships). The key feature of the smart specialization concept is that it "provides a clear policy-prioritization logic which is well suited to promoting innovation in a wide variety of regional settings, and in particular in the heterogeneous environment of European Union (EU) regions" (McCann and Ortega Argiles 2015:292). However, adopting a non-neutral policy stance entails difficulties such as "[h]ow to prioritise and favour some R&D and technological activities, some sub-systems or some fields, while not dissipating the extraordinary power of market-driven resource allocation in boosting decentralised entrepreneurial experiments?" (Foray 2014:503). Any model seeking to operationalise a smart specialisation-based policy will have to reconcile a non-neutral policy stance with facilitating market-driven resource allocation. That is, ensure that a market-based 'discovery process' is "at work that assembles

different [vertical] actors and will lead to the development of a new activity – at the cross-roads between a new technology and a traditional sector – and structural changes (modernisation and diversification) (Foray 2014:494).

The rationale behind vertical prioritisation is not dissimilar to approaches emphasising the interaction between sub-systems such as between suppliers and clients as the stimulus for innovation: the ‘user-producer interaction’ (Teubal 1977; von Hippel 2005). Creating the micro-sphere extends this user-producer interaction approach to include connections between those with latent talent, drawing them into the innovation system. In this way endogenous local economic growth takes place. Success depends on designing a mechanism that helps to vertically align sub-systems (and should be a key feature of any model). Under RIS3 the policymaker’s task is to design processes that identify and select likely areas for intervention i.e. non-neutral interventions which favour some sub-systems over others. “Vertical prioritisation is difficult; this is why smart specialisation is about defining a method to help policy makers identify desirable areas for innovation policy intervention” (Foray 2014:503). In contrast to the hypothetic-deductive method associated with the supply-side and the demand-side approaches, RIS3 is based on the inductive method whereby cognisance of the local situation is paramount; with the nature and individuality of the region being the focus of attention. RIS3 focuses on the heterogeneity between and within firms along with “the individual processes that generate industrial or regional productivity change and the different mechanisms that influence those processes” (Rigby and Essletzbichler 2000:334). RIS3 looks for ways to reduce the impact of the under-performing tail identified by Harris (2001) by using micro-level spatial data to identify the nature of firm heterogeneity, intrapreneurship, and absorptive capacity (the ability of the firm to internalize and employ external knowledge). It tries to identify the drivers of growth and to understand how the growth process works. This is the essence of the demand-led approach; it “is a policy approach that involves letting and helping the regional economy to discover new activities with strong potential; making a sound analysis of potential and defining a process which will empower those actors most capable of realising the potential” (Foray 2009:3).

While some aspects of a demand-led approach to innovation have been apparent in innovation systems policy for some time, these have tended to be specific programmes; these “efforts had not been built into the innovation policy portfolio systematically. They were introduced to serve specific policy objectives, rather than

innovation dynamics per se” (Elder 2013:5). A demand-led ‘smart’ system approach offers the opportunity to view a region through a different lens, identifying value in economic and social assets that currently remain under-valued (and hidden) from traditional policy perspectives. In the next section we look briefly at how smart specialisation may help restructure a region.

Looking again at the region

The work of Foray and the EU Expert Group has helped shape the EU’s 2020 Strategy, placing innovation policy within a region-specific context and where a bottom-up discovery-type approach to innovation may be adopted and the potential benefits to be attained (EU 2014a). The 2020 Strategy views this as a more fruitful policy stance, better able to address the continuing divergence found between and within EU regions. “Rather than being a strategy imposed from above, smart specialisation involves businesses, research centres and universities working together to identify a region’s most promising areas of specialisation, but also the weaknesses that hamper innovation. It takes account of the differing capacities of regional economies to innovate. While leading regions can invest in advancing a generic technology or service innovation, for others, investing in its application to a particular sector or related sectors is often more fruitful” (EU 2010:7). Regions are encouraged to be diverse and play to their strengths; with policymakers eschewing a homogeneous approach to development in preference to one based on ‘smart specialisation’ in local competitive advantage. “National and regional governments should, accordingly, develop smart specialisation strategies to maximise the impact of Regional Policy in combination with other Union Policies” (EU 2010:6). The task for policymakers is to design mechanisms that will enable the richness inherent in such diversity to emerge. The difficulties of such a task (enabling the discovery process to take place in addition to facilitating subsequent innovation activity) are likely to be greater than those associated with traditional industry-wide (horizontal) innovation policies, even though it was often difficult to identify sufficient projects for the available EU innovation funding (EU 2010).

At EU and Scotland level, policy concerns over differentials in competitiveness and productivity within and between regions are centred round issues of equity and social cohesion (Gardiner et. al. 2004; Skerratt 2013; EU 2014; Scottish Government 2015). Regions have sometimes been represented as if they were self-evident entities with their special and geographic characteristics influencing the nature of research (Lovering, 1999). In

contrast recent 'critical regionalism' literature provides a more dynamic view of regions; seeing them as social constructions based on shared identity that may be contingent, temporary, rhetorically-based spatial constructions (Scott and Storper 2003; Clark and Christopherson 2009). From a critical regionalism's perspective the ever-morphing region in many ways captures the essence of the demand-led approach in that relationships between players is often 'contingent' on a particular issue or project. This approach to regions aligns well with Storper's view that we are in an era of 'reflexive capitalism' where sharing and networking of information is replacing traditional market based competition. In this environment new kinds of risk are created and have to be managed by entrepreneurs and that "[w]inning has become a much more complex target, because the conditions...in order to win are manufactured and remanufactured more thoroughly and more rapidly than ever before, creating a moving target for success and a shifting minefield of risks and failures" (Storper, 1997:30).

Similarly, the entrepreneurial discovery process is about the "integration of dispersed knowledge, tension between private appropriation logic and spillover logic and provision of new specific public goods necessary to the growth of the new activity all represent difficulties that are not easily surmountable, often necessitating the implementation of a public policy" (Foray 2014:493). **The region** as understood by local authority and council boundary contains a complex mix of waxing and waning contingent relationships inherent within a reflexive capitalism framework (MacLeod 1998; Hausmann and Rodrik 2003). As such, the term 'region' often hides more than it reveals. For example, it may self-define persistent market failure due to levels of scale and scope which are impossible to achieve in a remote region (Dabrowski 2014). By doing so, it ignores mechanisms that encourages and supports contingent relationships and which facilitates experimentation to identify market opportunities that previously would have been deemed not to exist. The exciting prospect unfolds of businesses in rural regions having the potential to actively shape their destiny rather than be passive participants of top-down interventions within a tight set of parameters based on local factors and geographic endowments. A reflexive-capitalism framework provides the environment for Foray's 'discovery process' to take place, where firms are able to create social contacts and social networks that are built on trust and expanding social capital. In this way beneficial externalities and synergies take place that help to define the nature and boundary of a 'region' (Storper 1997; Harrison 2006). Beneficial externalities and synergies increase the number of connections between economic agents within the local eco-sphere, improving the flow

of knowledge and increasing the likelihood of localized knowledge spillovers. Storper (1997) calls this flow of knowledge ‘untraded interdependencies’ that are “forms of conventions, informal rules and habits that co-ordinate economic actors under conditions of uncertainty; these relations constitute region-specific assets in production. These assets are a central form of scarcity in contemporary capitalism, and hence a central form of geographical differentiation in what is done, how it is done, and in the resulting wealth levels and growth rates of regions” (Storper 1997:5). That is, untraded contingencies have an economic value. The entrepreneurial discovery process involves untraded contingency, creating the potential for transforming economic (regional) structures and building capabilities in new domains (Koryak, et.al. 2015). In this way “[a] region’s overall average wage... perhaps the most basic measure of its economic performance and most associated with its standard of living” (Porter 2003:550) is boosted. While opening up new and exciting possibilities for understanding the region in terms of an ever-shifting set of relationships between connecting players, others warn that there is a danger that “current research in the new regionalism is becoming chaotic by bundling together too many diverse theories for it to be a coherent intellectual project” (Harrison, 2006:2). We are not adding to this bundle. Rather, we have identified common strands from the discovery process and new regionalism that inform the design of our micro-sphere model; a model that enables the exploration of new ideas and formation of new combinations of knowledge from existing regional resources. In the next section we bring together elements from the strands of literature to conceptualise the model.

Conceptualising the micro-sphere model

The model aims to encourage a user-producer (vertical) discovery process enabling diverse enterprises to identify latent region-based value-adding activities. Such collaboration would be in *addition* to that which occurs spontaneously in the market, meaning any value-adding outcome represents pure additionality from the policy intervention. A model along these lines enables entrepreneurs to experiment and test ideas and to ‘discover’ innovative solutions and has the potential to transform a region, particularly a rural region. This is a different type of vertical engagement than that of MAR-type pecuniary externalities which drive agglomeration and which rely on a rent seeking behaviour. It is also distinct from MAR-type non-pecuniary externalities surrounding knowledge spillovers in that it involves a conscientious effort to create a knowledge spillover environment between user-producer. In many ways the model seeks to create the benefits of diversity associated with Jacobian-type externalities through the creation of a Platform that enables

economies of scope to be achieved in a non-urban setting. That is, the scale necessary to generate benefits from diversity no longer depend on the physical proximity as scattered rural firms make use of the model's Platform. In terms of start-up activity, Jacobian-type agglomerations appear to generate more start-up and spin-off activity and therefore help deepen local entrepreneurialism (Glaeser et. al. 1992; De Groot et.al. 2007). This evidence supports the model's aim of stimulating rural economic growth through placing the entrepreneur at the centre of the growth process, and contrasts with market-failure-based entrepreneurship programmes. Storey (1994), Shane (2009) and Nightingale and Coad (2014) each provide a critique of market-failure-based policies designed to boost growth by encouraging entrepreneurship. Scottish Enterprise's experience of its Business Birth Rate Strategy (BBRS) highlights the difficulties in aligning top-down policies with the realities on the ground (Fraser of Allander 2001). Relatively poor Scottish start-up rates persist to the present day as does the link between start-ups and firms of growth. Recent work by Brown and Mason (2014) present a cogent analysis of the failure of such policies as applied to technology-based entrepreneurship.

Foray et. al. (2009) identified the potential benefits of setting innovation policy within a local context and tailoring policies to suit specific circumstances. Innovation policy for the regions should be 'smart' and specialise in area where regions have areas of expertise or other competitive advantage: so-called smart specialisation. Foray et. al. (2009) provide the academic context within which a smart specialisation approach to innovation policy may be set. At the centre of innovation policy should be a mechanism(s) through which the entrepreneurial discovery process is able to take place and which facilitate local opportunities for exploring innovation (of all types). Discovery precedes the innovation stage and involves exploration of new domains of opportunities thereby increasing the likelihood of innovation, with generation and diffusion of knowledge spillovers a key component of this process. "The entrepreneurial discovery, integration of dispersed knowledge, tension between private appropriation logic and spillover logic and provision of new specific public goods necessary to the growth of the new activity all represent difficulties that are not easily surmountable, often necessitating the implementation of a public policy" (Foray 2014:493). Entrepreneurial discovery and exploration of new domains of potential innovations involves frameworks or mechanisms (however created) that bring together knowledge that is dispersed across a region. As Foray (2014) notes, discovery can be spontaneous, particularly in highly successful regions (success breeds success); the challenge for policymakers is designing models of intervention that foster the discovery process, particularly in areas where spontaneous

discovery is weak. The proposed model seeks to help policymakers with this challenge by creating a vehicle where Jacobian-type spillovers can take place.

Any such model needs to reconcile the inherent tension which occurs when policymakers have to decide where to lend support while at the same time ensuring that such support does not weaken market-driven resource allocation (Foray et.al.2009; Foray 2014). Market-driven resource allocation is an essential feature of a demand-led approach and any model must provide a framework within which policymakers can align elements of the local economy with general purpose technology and emerging innovation in a way that supports local strategic priorities. The model must create an environment conducive to innovative activity while leaving the dynamics of the market to flourish: that is, 'inventing intelligently designed policies' (Foray 2014). It enables policymakers to "favour the emergence and development of a few 'innovation micro-systems' dealing with particular market niches and mostly related to existing productive structures and assets in order to transform them through R&D and innovation (structural changes)" (Foray 2014:503). The region's existing productive structures and assets are thus able to be combined in new and more effective ways, with regions playing to their strengths rather than following a prescriptive pan-region blueprint.

The model's two domains are those inherent in smart specialisation: firstly a non-neutral policy stance whereby policymakers 'decide' which area of the economy to support, and secondly a focus on the vertical relationships within this selection. That is, "selects projects according to preferred fields, sectors or technologies" rather than horizontal policy activity which responds only to "demands that arise spontaneously from industry" (Foray 2014:500). These domains are encapsulated within the dotted line of the model in Diagram 1, and represent the 'knowable' activity that takes place within a Foray-style 'intelligently designed' system. That is, the "particular market niches" and "existing productive structures and assets" that form part of the non-neutral policy stance.

The key feature of the model is the Platform and its facility to bring together diverse enterprises that is independent of geography. That is, the Platform provides a means for economies of scope to take place in a rural economy and for the creation of Jacobian-type spillovers. The Platform acts as a form of network-based innovation brokerage (NBIB). This form of brokerage moves beyond the gains associated with traditional

network which views innovation as a linear process involving the transfer of new technology from R&D institutions to enterprises (Godin 2006; Svare and Haugen Gausdal 2015). Rather than being such a conduit, the NBIB-based Platform facilitates a market-driven ‘discovery’ process by providing a form of reflexive capitalism haven. This haven enables a pooling of entrepreneurial knowledge available in compact form within one single entity (Bresnahan 2012) supporting entrepreneurial Jacobian-type knowledge spillovers. As such it helps lessen issues surrounding appropriation of information externalities due to the gap between social and private returns to any discovery (Nelson 1959; Arrow 1962; Trajtenberg 2012). It is a *safe* environment where entrepreneurs collectively engage in the processes of experimentation and discovery, enabling them to re-evaluate and re-combine *existing productive structures and assets* to discover and exploit market opportunities (Bergek et. al. 2008; Svare and Haugen Gausdal 2015). In this way diversity is achieved “across industrial sectors so that new ideas and technologies are able to enter the regional mainstream” (Cheshire and Malecki 2004:258).

The Platform does not *cause* innovation; rather, by facilitating innovative-based demand-led value creation it enables a process of ‘effectuation’ to take place (Sarasvathy 2001; Sarasvathy and Dew 2005). This is similar to the ‘noisy selection’ process described by Jovanovic (1982) and can be done in relative safety in terms of cost of failure (i.e. experimentation can be undertaken, tentative alliances formed and potential demand identified). Thus, a region’s *existing productive structures and assets*, including dormant capabilities and under-utilised capital may, in collaboration with others, *transform them through R&D and innovation* bring about growth through regional structural change. This is endogenous growth and structural change.

Diagram 1 around here

What was once un-economic now become economic. In each case, hidden innovation is revealed. In each case, growth occurs that is commensurate with the nature of the local economy. This is organic growth based on local responses to new-found market opportunities (Koryak, et. al. 2015). Given the transient nature of the relationships within a system of reflexive capitalism, policymakers should expect each non-neutral policy stance to evolve and to have an exit strategy in place once ‘escape velocity’ has been reached i.e. the market-driven side of the model becomes self-supporting. The level of support can be amended in real-time in

response to the feedback and market intelligence. This contrasts with traditional, backward looking, economic development programmes which normally begin with a project appraisal process identifying a particular market failure and ends with an evaluation. A demand-led approach enables a region to play to its strengths by encouraging entrepreneurs to identify opportunities utilising economies of scope. Thus, the level of analysis becomes the operations of individual entrepreneurs and their capabilities rather than the sector or industry. This approach lessens the need to achieve the critical mass for competitive success has bedevilled regional policy (OECD 2011a, Foray 2014; Georghiou et. al. 2014).

Diagram 2 shows how the Platform brings together disparate vertical sets of networks and represents a distinct departure from the traditional policy-neutral approach based on addressing industry-wide (horizontal) concerns. Supporting the platform would be aspects of supply-led policy such as elements from programmes, projects and interventions currently delivered by development agencies according to specific demand. The model views intervention working in novel ways and in a demand-led manner; support being called upon and delivered in a form that enterprises need at any particular time. In this way the model provides a valuable bridge between policy intentions and market driven need.

Diagram 2 around here

The micro-sphere model provides the conceptual framework for policymakers to operationalise a demand-led approach to strategy; an approach that helps reveal value in the local economy that would otherwise have remained hidden using a top-down approach. The salient points are these: firstly, policymakers, reflecting current policy (strategy) need, identify the sub-systems and design a suitable platform; secondly, market forces determine the eventual outcomes of this policy by means of the discovery process; thirdly, these outcomes are, ex ante, unknowable and indeterminate; fourthly, enterprises find additional value due to economies of scope and, fifthly, being organically-rooted and with increasing local connections, economic growth is more resilient to external shocks.

In the next section we look at the rationale for adopting a smart specialisation policy at the level of the region before moving on to a case study that assesses the model against the strategy intentions of a rural region in

Scotland (Dumfries and Galloway). We do this in order to show how the model may be used to support strategic thinking. The case deals solely with the design of a policy stance and an example of the Platform in use. Outcomes arising from the market-driven process will always be unknowable until after the model is operationalised.

Rationale for adopting a smart specialisation policy at a regional level: the case of Dumfries and Galloway

Dumfries and Galloway is a rural region of Scotland with a population around 160,000, displaying many of the characteristics of rural areas such as low-wage employment, an aging population and high levels of deprivation. 89 per cent of the business base of 5,300 firms is classified as microbusinesses, with only 65 employing more than 50 people. The preponderance of agricultural, retail and self-employment (19 per cent) means GVA per hour worked is 82 per cent of the Scottish average; with a lower rate of knowledge intensive businesses compared to the Scottish average (12 per cent: 28 per cent). At 19 per cent the rate of self-employment is significantly above the Scottish average of 12 per cent. High-value added sectors such as Creative Industries (digital business), Energy (particularly renewables and their supply chain) and Forest and timber technologies are bright spots (Dumfries and Galloway Council 2015).

Evidence from the EU suggests that the top-down approach has encouraged lagging regions to attempt to mimic knowledge-based regions and attempt to become leaders in technology or create centres of excellence but with neither the depth nor scale to achieve critical mass (Arnold 2014). Under the OECD's typology there are three types of innovation region: knowledge regions; industrial production zones; and non-science and technology-driven regions (so-called lagging regions). Dumfries and Galloway falls under the latter classification. In terms of productivity (GVA per hour worked), Dumfries and Galloway ranks twenty out of the twenty-four NUTS 3 sub-regions of Scotland (ONS 2015). Other 'remote' regions display similar lagging tendencies. Dumfries and Galloway performs poorly relative to the other border region (Scottish Borders) making action to halt this relative decline a matter of local imperative. As we have seen, smart specialisation provides a conceptual framework for identifying, within the existing regional structures, potential innovation pathways that may have the potential to arrest the decline (Foray et. al. 2009). Smart specialisation means that each region's specific characteristics determines its knowledge eco-sphere, with no two regions being the same. The relative failure of the top-down approaches to reduce regional disparities in levels of productivity

and growth is due in part to the inability to influence region-specific characteristics. There are layers of complexity within communities that are often invisible to policymakers (Skerrat and Stiener 2013). Dumfries and Galloway's task is to 'specialise' in areas where it has strengths, and to introduce smart specialisation to the policy mix. As Foray says, it is about using existing *productive structures and assets* smarter to bring about structural change and regional growth.

Increased interest in demand-led policies reflects a general perception that traditional supply-side policies (top-down approach) have not been able to improve productivity and innovation levels (OECD 2011b). A demand-led strand to economic development strategy would complement current supply-led activity, particularly in areas where the market has not brought forth such activity (Georghiou et. al. 2014). Currently, there are incentives for regions and countries to adopt smart specialisation under European Structural and Investment Funds (ESIF) for the period 2014-2020. "Smart specialisation is precisely the strategic approach to better target and focus research and innovation investments on inherent (regional) strengths while also broadening the approach to incorporate many more actors, be they universities or small- and medium-sized clusters of companies and knowledge institutes, which is essential to matching own strengths with business needs and real market opportunities" (EU 2014:3).

In addition to the potential financial incentives attached to RIS3 adoption, there is a broader strategic imperative. RIS3 is placed within the EU's Europe2020 Strategy, the aims of which are designed to address persistent regional disparities through progress in three mutually reinforcing priorities:

1. Smart growth, based on knowledge and innovation;
2. Sustainable growth, promoting a more resource efficient, greener and competitive economy (circular economy), and
3. Inclusive growth, fostering a high employment economy delivering economic, social and territorial cohesion. (European Commission 2010:11)

Dumfries and Galloway's Regional Economic Strategy is aligned with the Europe2020 Strategy, where the focus is stated to be on 'smart', sustainable and inclusive growth (Dumfries and Galloway Council 2015). Similarly, Scotland's Economic Strategy makes explicit the link between economic growth and inclusivity in its twin strategic pillars: increasing competitiveness and tackling inequality (Scottish Government 2015). Both

documents assume a complementarity between economic growth and social cohesion despite some evidence that these may be mutually incompatible in policies designed to promote regional convergence (McCann and Ortega 2015). Neither Scottish strategy document mentions any specific demand-led activity; despite being more suitable for reconciling aims of growth and social cohesion (EU 2014; Foray 2014). This is a major omission and suggests that Scottish strategic thinking remains focused on a top-down approach, delivering projects and programmes to relatively passive recipients (with the relative lack of impact noted earlier). It is recognised that there will be some projects and programmes that do involve elements of bottom-up activity, but this is not the demand-led strand to strategy that Europe 2020 envisioned: “an integrated, place-based economic transformation agenda that does five important things:

1. Focus policy support and investments on key national/regional priorities, challenges and needs for knowledge-based development, including ICT-related measures;
2. Build on region’s strengths, competitive advantages and potential for excellence;
3. Support technological and practice-based innovation aiming to stimulate private sector;
4. They get stakeholders fully involved and encourage innovation and experimentation;
5. They are evidence-based and include sound monitoring and evaluation systems.” (European Commission 2012:8)

To show the possibility of introducing a demand-led strategy to Dumfries and Galloway we map the region’s six planned Strategic Activities¹ against the Commission’s five imperatives. The strategic activities are:

1. Capitalising on the strength of the region’s base to increase productivity and provide the conditions for business-led growth;
2. Empower the region’s communities to address their distinct economic challenges and opportunities;
3. Create a vibrant culture of opportunity in the region to retain and attract people of working age and improve the competitiveness of individual businesses;
4. Enhancing regional connectivity, removing barriers to business competitiveness and improving access to economic opportunities for individuals and businesses;
5. Large investment projects that will make a significant impact on the regional economy, and

¹ Success is measured against achieving the following The highest youth employment rate in Scotland by 2020; business growth has grown faster than in Scotland as a whole between 2015 -20, and reducing the wages gap between the regional and national average by 20 per cent. (Dumfries and Galloway Council, 2015).

6. A shared vision and partnership working across the public, private and third sectors along with our providers of further and higher education. (Dumfries and Galloway 2016:14)

Doing so demonstrates that there is no policy barrier to adopting a demand-led approach along the lines prescribed in Europe 2020. Mapping reveals that Strategic Activities 1,2,3,4 and 6 can be aligned with a demand-led approach and are able to be operationalised through the proposed micro-sphere model.

We now place Strategic Activities 1,2,3,4 and 6 within the model, focusing on the domain where policy can be affected: i.e. the policy stance and design of the Platform. Adopting a micro-sphere approach avoids large investment projects because current assets and facilities are re-configured (used smarter) to provide the desired outcomes. The case study uses the Strategic Activities to populate our model and to illustrate how the difficult task of vertical prioritisation might be tackled. It is for demonstration purposes only as more work needs to be done to test the model in the field. According to Foray, "Vertical prioritisation is difficult; this is why smart specialisation is about defining a method to help policy makers identify desirable areas for innovation policy intervention (Foray 2014:503). Our proposed micro-sphere model is the method.

The case study: populating the model

Strategic Activities 1 and 6: The region's potential competitive advantage and a shared vision

According to Acs and Audretsch (1987) small firms have a relative innovative advantage over their larger counterparts in highly innovative industries and that in many other less innovative industries small firms gain market share (Audretsch et al, 2002). Dumfries and Galloway has a comparative advantage in small and micro firms with 20 per cent of the region being self-employed against 12 per cent for Scotland (Talbot 2015). Of the 13,900 self-employing business, around 10,700 are home-based business spread across the region and industry sector. Co-worker and maker spaces would enable this potentially large market to connect in ways not previously possible and thus help develop the sharing economy of Dumfries and Galloway. In addition, such provision would help overcome a major problem of loneliness often attached to those working from home; the so-called Age of Loneliness (Walker 2003; Thompson et. al. 2009). For example, artistic, creative and community groups' current extensive networking would be 'boosted' by becoming a dynamic value constellation and able to feed into the design and creative needs of local innovative firms. Kapasi and Galloway

(2016) provides some rich case study material on the nature of HBBs in a rural setting showing the latent potential of such enterprises.

Strategic Activities 2 and 3: Empowering communities and a culture of opportunity

The emerging *sharing economy*, the central feature of which is that access to assets, rather than ownership, can be a powerful economic driver. This is due to the reduction in economic slack as under-utilised assets are drawn into the system. Remoteness often means that assets are not fully employed and this is reflected in remote regions having lower average rates of productivity and average income (ONS). While tending to under-perform most Scottish regions due in large part to remoteness, Dumfries and Galloway is well placed to benefit from the new wave of technological developments bringing forth *Internet of Things* and the *Sharing Economy*. Sweden shares the region's characteristics of remoteness and small-scale home-based enterprises, but has become a global innovation hot-spot by embracing new technology and devising novel ways of combining its human, social and economic capital (Fellander, Ingram and Teigland 2015). Remoteness and small scale are no longer barriers to growth if the necessary infrastructure and policies are in place to enable a region to exploit emerging technologies.

Strategic Activity 4: Enhanced regional connectivity

A major development arising from the Dumfries and Galloway-based Scottish Funding Council funded Crichton Institute² is the Regional Observatory (RO)³, an online portal providing open-access data on the local and Scottish economies. The Observatory has the capacity to host information on the nature and location of each aspect of the proposed platform. This is an example of using existing general purpose technology to enable a degree of networking between key players, enabling local solutions to fit local circumstances. Through the RO it will be possible to ensure that all facilities would be connected, opportunities shared and interaction with the wider business community.

² The Crichton Institute is a Scottish Funding Council Partnership for Knowledge Creation and Exchange in South West Scotland. <http://crichtoninstitute.co.uk/>

³ The Regional Observatory is a web-based front door to the Crichton Institute.
<http://crichtoninstitute.co.uk/index.php/regional-observatory>

The Platform

The platform acts as a medium, facilitating the three components: competitive advantage in home-based businesses; their potential to develop businesses based on the sharing economy; and using the Regional Observatory. In this case study we identify the platform as consisting of co-worker and maker-spaces. The nature of co-worker and maker spaces⁴ facilitates the 'entrepreneurial discovery process', enabling key aspects of specialisation to take place (Foray 2009). In this case, for a lagging region such as Dumfries and Galloway, specialisation would be in non-technical innovation e.g. discovering ways to exploit and share general purpose technologies (GPT). In this way the Platform facilitates diverse enterprises to benefit from economies of scope. GPT enables holders of tangible and intangible resources to identify and share any 'slack' with others in similar situations. The smart specialisation framework recognises the role of both technological and non-technological innovation in the process of specialisation/diversification. Co-worker and maker space potential impacts include:

1. Reducing the level of slack⁵ in the economy by reducing under-utilised council assets and potential collaboration and innovation from co-working companies and organisations);
2. Reducing costs and thereby improving GVA;
3. Increasing the 'connectedness'⁶ within and beyond the local economy;
4. Improving GVA through the likelihood of new revenue generating products and services;
5. Enabling smoother structural change at the regional level, and
6. Improving the effectiveness of enterprise strategy (Stokes 2014).

Diagram 3 shows how the policy stance would operate. By bringing together the (in this case three) components, the platform (consisting of a set of co-worker and maker spaces) facilitate a demand-led value creation process where experimentation and discovery activity between home-based businesses can take in a benign environment. Agency intervention takes the form of bespoke assistance to the platform. Real-time feedback ensures this support is relevant, bespoke and entails an exit route. Thus there is no need to wait for end-of-programme evaluation to assess effectiveness as there would be real-time feedback. In this example

⁴ Maker spaces are defined as an open access space (free or paid), with facilities for different practices, where anyone can come and make something. Maker spaces differ from private or single-practice workshops and studios despite many similarities. (NESTA)

⁵ The proposal aligns with D&G Council's ambitions for addressing idle resources:
<http://www.dumgal.gov.uk/index.aspx?articleid=4182&item=1100>

⁶ According to Hausmann, Hidalgo et al., increasing connectedness and economic complexity is a major component in economic growth.

the support would come from one or more of the six strategic objectives⁷ under Dumfries and Galloway's strategic plan. Lightness of touch and flexibility ensures that policy supports the discovery process, letting the market identify value opportunities. Alliances between participating enterprises would arise and subside within this reflective capitalism environment.

Diagram 3 around here

The delivery model

The aim of a smart specialisation strategy is to support the creation of a few 'innovation micro-systems' that deal "with particular market niches and mostly related to existing productive structures and assets in order to transform them through R&D and innovation (structural changes)" (Foray 2014:503). Co-worker and maker spaces take many forms and in the spirit of the bottom-up approach existing facilities and resources would be *reconfigured* or matched with complementary resources to provide the kind of space a locality would require. Diagram 4 shows a spectrum of space-type that would enable the entrepreneurial discovery process to take place. Each point on the spectrum provides opportunity for business development assistance and mentoring on a client-led basis, avoiding the concerns associated with a top-down programmatic approach. Examples of existing spaces include:

1. Spare capacity in local authority, national agencies and other public sector buildings offer an immediate and relatively cost-free entry to co-worker spaces where bespoke advice could be provided;
2. Current venues (e.g. hosting creative groups) could be connected to business and design advice, and
3. Redundant space in High Streets could be re-instated and a range of services offered e.g. from basic coffee and desk space through to a fully equipped design studio with business and design advice, depending on the type and level of demand within the locality.

Diagram 4 around here

⁷ These are: More Growing Businesses, Developing Places, Better Skills, Better Opportunities, Well Developed Infrastructure, Investment Projects, Intelligence, Leadership and Influence. (Dumfries and Galloway Strategy 2016, p15)

The business model

A common strand of the many variations of business model under which co-worker and maker spaces operate is revenue generation (Sleigh Stewart and Stokes 2015). Clients access a spectrum of services, on an hourly, daily, weekly or monthly basis; with a variety of support packages available. It would be expected that each space would be largely self-financing (covering running costs at a minimum). The economics of each facility would differ with some being fully commercial while others attracting some support from external bodies. Development agencies could fund some clients as part of a bespoke client-led support package (instead of a supply-led, top-down, product-driven approach).

The policy framework

Diagram 5 is an initial attempt to arrive at a stylized policy framework and reflects the discussion so far in our attempt to return the entrepreneur to regional growth process. It distils the essence of our discussion and shows the outline of what a policy framework enabling a dual stance approach to strategy would look like. Our discussion has focused on introducing a non-neutral policy stance through adopting a smart specialisation approach to some interventions. Foray (2014) identifies the selection of the subsystems is the most difficult aspect of such policy. Diagram 5 illustrates one method for overcoming this difficulty by aligning the region's strategic priorities with region-specific attributes. In our case study above we undertook such an alignment and from this identified a rationale for selecting a sub-sector and the type of Platform to create, co-worker spaces in the case of Dumfries and Galloway. Clearly more detailed work would need to be done to do this in practice, but the aim of the paper is to demonstrate a basic roadmap for attempting doing so.

The experimentation and discovery processes then become market-driven exercises as diverse enterprises interact in a manner that had not been possible previously. The nature of any intervention would come from this process and thus be demand-led. Diagram 5 shows a feedback mechanism whereby existing support could be tapped to provide bespoke assistance. Assistance is only offered when it is requested and real-time feedback and on-going evaluation of the intervention means that an exit strategy does not depend on the ending of a programme. There is no industry one-size-fits-all programmatic response.

Diagram 5 stylises a demand-led-strand to strategy that Europe 2020 envisioned, It “does five important things:

1. Focus policy support and investments on key national/**regional priorities**;
2. Build on **region’s strengths**, competitive advantages and potential for excellence;
3. Support technological and practice-based innovation aiming to **stimulate private sector**;
4. They get stakeholders fully involved and **encourage innovation and experimentation**;
5. They are evidence-based and include **sound monitoring and evaluation systems**.” (European Commission 2012:8)

Diagram 5 around here

In summary

We began with a brief look at the issue of secular stagnation. We did this to contextualise some of the issues surrounding investment, innovation and economic growth. Risk aversion in the corporate sector and the rise of financialisation have gone some way to produce a low-level equilibrium where any growth is the result of increased numbers of labour rather than improved productivity.

Next we looked at the concept of smart specialisation returns the entrepreneur to the centre of the innovation process with the potential of such policies to boost growth, particularly at the level of the region. Smart specialisation offers the prospect of regions building resilience through effecting structural change by inventing *intelligently designed policies using existing productive structures and assets* (Foray 2014).

The paper looked at a number of related themes across the literature to create a conceptual model that can be used to operationalise a strategy for smart specialisation. The model creates an environment where diverse rural enterprises are able to benefit from Jacobian-type spillovers by means of a Platform which provides a reflexive-capitalism environment enabling contingent interaction to take place between entrepreneurs. Thus the model provides the means for resolving the dichotomy inherent in intervention policies: the danger that intervention weakens market dynamics.

The model captures the circularity of the entrepreneurial process (Svare and Haugen Gausdal, 2015) and is designed to help policymakers identify desirable areas for policy intervention while at the same time avoiding

the dangers associated with ‘picking winners’ (Hausmann and Rodrik 2003). Above all it is a model that sees the merits of a bottom-up approach to innovation and with the entrepreneur as the driver for endogenous growth in the rural economy. The model enables entrepreneurs to use *existing productive structures and assets* smarter.

Acknowledgments

The author would like to thank Eva Milroy and Tony Fitzpatrick of the Crichton Institute for their support and for guidance on the Dumfries economy.

Thanks are also due to the two referees whose perceptive comments have helped improve the paper. Any remaining errors are the author.

Funding

This work is an output of the Crichton Institute, Dumfries and Galloway, a Scottish Funding Council initiative.

References

ACS ZJ and AUDRETSCH DB (1987) Innovation, market structure, and firm size. *Review of Economics and Statistics* 69 (4): 567-74.

Armstrong HW and J Taylor (2000) *Regional Economics and Policy*, Oxford: Blackwell.

Arnold E (2014) Evaluating research and innovation policy: a systems world needs systems evaluations. *Research Evaluation* 13 (1): 3–17.

Arrow K (1962) Economic welfare and the allocation of resources for invention. In: Nelson, R. (Ed.) *The Rate and Direction of Inventive Activity: Economic and Social Factors*: Princeton University Press, Princeton, NJ.

Asheim BT and Gertler MS (2005) The Geography of Innovation: Regional Innovation Systems. In: Fagerberg J Mowery DC Nelson RR *The Oxford Handbook of Innovation*. Oxford: Oxford University Press, pp290–317.

Asheim BT Smith HL and Oughton C (2011) Regional innovation systems: Theory, empirics and policy. *Regional Studies* 45 (7): pp 875–891.

Audretsch DB and Thurik R (2002) Linking entrepreneurship to economic growth. OECD Working Paper 2081/2.

Audretsch DB and Thurik R (2001) Linking Entrepreneurship to Growth. OECD Science, Technology and Industry Working Papers, 2001/02, OECD Publishing. <http://dx.doi.org/10.1787/736170038056>

Audretsch DB Thurik AR Verheul I and Wennekers AR (Eds.) (2002) *Entrepreneurship: Determinants and Policy in a European–US Comparison*. Kluwer Academic Publishers.

Bergek A Jacobsson S Carlsson B Lindmark S and Rickne A (2008) Analyzing the Functional Dynamics of Technological Innovation Systems: A Scheme of Analysis. *Research Policy* 37 (3):407–429.

Boddy M Hudson J Plumridge A and Webber DJ (2005) Meeting the Productivity Challenge: final report on a study carried out for the South West of England Regional Development Agency, Exeter.

Breschi S and Lissoni F (2001) Knowledge spillovers and local innovation systems: A critical survey. *Industrial and Corporate Change* 10 (4): 975-1005.

Brown R and Mason C (2012) Raising the batting average: Re-orientating regional industrial policy to generate more high growth firms. *Local Economy* 27 (1):33–49.

Brown R and Mason C (2014) Inside the high-tech black box: A critique of technology entrepreneurship policy. *Technovation* Available at: <http://dx.doi.org/10.1016/j.technovation.2014.07.013> (Accessed 23 May 2016.)

Bresnahan T (2012) Generality, recombination and reuse. In: Lerner J and Stern S (Eds) *The Rate and Direction of Inventive Activity Revisited*. The University of Chicago Press, NBER, Chicago IL.

Cato Institute (2013) Why growth is getting harder. Policy Analysis No. 737. Available at: http://object.cato.org/sites/cato.org/files/pubs/pdf/pa737_web_1.pdf. (Accessed 25 March 2016)

Cheshire PC and Malecki EJ (2004) Growth, development, and innovation: A look backward and forward. *Regional Science*. 83:249-267.

Clark J and Christopherson S (2009) Integrating Investment and Equity: A Critical Regionalist Agenda for a Progressive Regionalism. *Journal of Planning Education and Research* 28 (3):341-354.

Cooke P (1997) Regions in a Global Market: the Experience of Wales and Baden-Wurttemberg, *Review of International Political Economy*. 4:349-381.

Dabrowski M (2014) Towards place-based regional and local development strategies in Central and Eastern Europe? EU cohesion policy and strategic planning capacity at the sub-national level. *Local Economy*. 29(4–5):378–393.

Dannreuther C (2009) The political economy of entrepreneurship. *International Small Business Journal*. 27(1–2): 522–524.

David P Foray D and Hall BH (2009) Measuring Smart Specialisation: The Concept and the Need for Indicators. Knowledge for Growth Expert Group (Available at: <http://cemi.epfl.ch/files/content/sites/cemi/files/users/178044/public/Measuring%20smart%20specialisation.doc> (Accessed 24 May 2016.)

De Groot HLF Poots J and Smit MJ (2007) Agglomeration, Innovation and Regional Development, Tinbergen Institute Discussion Paper 079/3. Available at: <http://papers.tinbergen.nl/07079.pdf> (Accessed 7 October 2017.)

Dumfries and Galloway Council (2015) Dumfries & Galloway Regional Economic Strategy 2014 – 2020: Baseline Study and Regional Economic Profile Produced by Crichton Institute for Dumfries and Galloway Council Economic Development Service and Community Planning Executive Group.

Dumfries and Galloway Council (2014) Dumfries & Galloway Regional Economic Strategy 2014 – 2020.

Dumfries and Galloway (2016) Dumfries and Galloway Regional Economic Strategy 2016-2020.

Edquist C (2005) Systems of Innovation: Perspectives and Challenges. In: Fagerberg J Mowery DC and Nelson RR (eds) *The Oxford Handbook of Innovation*. Oxford: Oxford University Press, pp181–208.

Elder J (2013) Review of Policy Measures to Stimulate Private Demand for Innovation. Concepts and Effects. Nesta Working Paper No. 13/13.

Epstein GA (2006) Financialization and the World Economy. Edward Elgar.

Etzkowitz H and Leydesdorff L (2000) The Dynamics of Innovation: From National Systems and Mode 2" to a Triple Helix of University–Industry–Government Relations. *Research Policy* 29(2): 109–123.

EU 2010 Regional Policy contributing to smart growth in Europe 2020COM (2010) 553. Available at: http://ec.europa.eu/regional_policy/sources/docoffic/official/communic/smart_growth/comm2010_553_en.pdf (Accessed 31 May 2016.)

European Commission (2010) 2020:A strategy for smart, sustainable and inclusive growth. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF>. (Accessed 14 June 2016.)

European Commission (2012), Guide to Research and Innovation Strategies for Smart Specialisations. Available at: http://ec.europa.eu/regional_policy/sources/docgener/presenta/smart_specialisation/smart_ris3_2012.pdf. (Accessed 14 June 2016.)

European Commission (2014), Smart Specialisation and Europe's Growth Agenda (2014) ISBN 978-92-79-37222-3. Available at: http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/smart_spec_growth_agenda.pdf. (accessed 14 June 2016)

Feldman, M.P. (1999) The New Economics of Innovation, Spillovers and Agglomeration: A Review of Empirical Studies, *Economics of Innovation and New Technology*. 8:5-25.

Felländer A Ingram C and Teigland R (2015) Sharing Economy: Embracing Change with Caution. Entreprenörskapsforum. ISBN: 978-91-89301-75-7.

Foray D (2009) Structuring a policy response to a Grand Challenge. In: Knowledge for Growth Prospects: For science, technology and innovation. Available at: http://ec.europa.eu/invest-in-research/pdf/download_en/selected_papers_en.pdf

Foray D (2012) Economic Fundamentals of Smart Specialisation. *Ekonomiaz*. 83:5-82.

Foray D (2014) From smart specialisation to smart specialisation policy. *European Journal of Innovation Management*. 17(4): 492 – 507.

Foray D David PA Hall B (2009) Smart Specialisation: The concept. Knowledge Economists Policy Brief No. 9 DG Research, Brussels. June 2009. Available at: http://ec.europa.eu/invest-in-research/pdf/download_en/kfg_policy_brief_no9.pdf?11111 (Accessed 26 May 2016.)

Fraser of Allander (2001) Promoting business start-ups: A new strategic formula. Stage One Progress Review. Final Report University of Strathclyde.

Fraser of Allander Institute (2001) Promoting Business Start-ups: A New Strategic Formula Stage 1: Progress Review: Final Report Glasgow: University of Strathclyde

Gardiner B Martin R Tyler P (2004) Competitiveness, productivity and economic growth across the European regions. *Regional Studies*. 38(9): 1045-1067.

Georgiou L Uyarrá E Saliba Scerri R Castillo N and Harper JC (2014) Adapting smart specialisation to a micro-economy – the case of Malta. *European Journal of Innovation Management*. 17(4): 428-447.

Glaeser EL Kallal HD Scheinkman JA and Shleifer A (1992) Growth in Cities. *Journal of Political Economy* 100(6): 1126-1152.

Hausmann R Hidalgo CA Bustos S Coscia M Chung S Jimenez J Simoes A and Yildirim MA (2012) Puritan Press, Cambridge MA. ISBN-10: 0615546625.

Glaeser E, Kolko J and Saiz A (2001) Consumer City, *Journal of Economic Geography*. 1:27-50. Available at: http://scholar.harvard.edu/files/glaeser/files/consumer_city.pdf (Accessed 6 October 2016.)

Godin B (2006) The Linear Model of Innovation: The Historical Construction of an Analytical Framework. *Science, Technology & Human Values*. 31(6): 639–667.

Gordon RJ (2015) The Economics of Secular Stagnation: A Supply-Side View. *American Economic Review: Papers & Proceedings*. 105(5):54–59.

Griliches Z (1992) The Search for R&D Spillovers, *Scandinavian Journal of Economics*. 94:29-47.

Hansen AH (1939) Economic Progress and Declining Population Growth. *The American Economic Review*. 29(1): 1-15.

Harris R (2001) Comparing Regional Technical Efficiency in UK Manufacturing Plants: The Case of Northern Ireland 1974 – 1995. *Regional Studies*. 35(6):519-534.

Harris R (2008) Models of Regional Growth: Past, Present and Future. SERC Discussion Paper 2. Available at: <http://www.spatialeconomics.ac.uk/textonly/SERC/publications/download/sercdp0002.pdf>. (Accessed 2 July 2016.)

Harris R and Li Q (2005) Establishment level empirical study of links between exporting, innovation and productivity, report submitted to UKTI, December 2005.

Harrison J (2006) Re-reading the new regionalism – a sympathetic critique. *Space and Polity*. 10(1):21-46.

Hausmann R and Rodrik D (2003) Economic Development as Self-Discovery. *Journal of Development Economics*. 72: 603-633.

Henrekson M (2005) Entrepreneurship: a weak link in the welfare state? *Industrial and Corporate Change*. 14(3):437–467.

Hudson R (2007) Regions and Regional Uneven Development Forever? Some Reflective Comments upon Theory and Practice. *Regional Studies*. 41(9):1149–1160.

Hudson M (2015) Killing the Host: How Financial Parasites and Debt Bondage Destroy the Global Economy. Perseus Books Group. ISBN 1568587376.

IMF (2015) The Corporate Saving Glut in the Aftermath of the Global Financial Crisis. Available at: <http://www.imf.org/external/np/seminars/eng/2015/secularstag/pdf/Gruber.pdf>. (Accessed 2 October 2016.)

IMF (2016) World Economic Outlook: Too Slow for Too Long. April 2016. Available at: <http://www.imf.org/external/pubs/ft/weo/2016/01/>. (Accessed 13 April 2016.)

Jovanovic B (1982) Selection and the evolution of industry. *Econometrica*. 50(3):649–670.

Kapasi I and Galloway L (2016) Motivations and mitigating business limitations in Scottish rural home-based businesses. *Local Economy*. 31(3):377–392.

Kapetanios G Mumtaz H Stevens I and Theodoridis K (2012) Assessing the economy-wide effects of quantitative easing. Working Paper No. 443. Bank of England.

Koo J (2005) Technological Spillovers, Agglomeration, and Regional Economic Development, *Journal of Planning Literature*. 20:99–115.

Koryak O Mole K F Lockett A Hayton JC Ucbasaran D and Hodgkinson GP (2015) Entrepreneurial leadership, capabilities and firm growth. *International Small Business Journal*. 33(1):89–105.

Lovering J (1999) Theory Led by Policy: The Inadequacies of the 'New Regionalism' (Illustrated from the Case of Wales., *International Journal of Urban and Regional Research*. 23(1):379–396.

Lundvall BA (2010) Towards a Theory of Innovation and Interactive Learning: In National Systems of Innovation: edited by Lundvall BA. Anthem Press, London. pp1–19. ISBN 9781843318668

MacLeod G (1998) In what sense a region? Place hybridity, symbolic shape and institutional formation in (post) modern Scotland. *Political Geography*. 17:633-663.

MacLeod G (2000) The learning region in an age of austerity: capitalizing on knowledge, entrepreneurialism, and reflexive capitalism. *Geoforum*. 31:219-236

McCann P and Ortega-Argiles R (2013) Smart specialization, regional growth and applications to European Union Cohesion Policy. *Regional Studies*. 49(8):1291–1302.

Martin C and Milas C (2012). Quantitative Easing: a Sceptical Survey. Working Paper. Bath, U. K.: Department of Economics, University of Bath. (Bath Economics Research Working Papers; 2/12). Available at: <http://www.bath.ac.uk/economics/research/working-papers/2012-papers/02-12.pdf>. (Accessed 13 April 2016.)

Mason C and Brown R (2013a) Entrepreneurial ecosystems and growth oriented entrepreneurship. Background paper prepared for the workshop organised by the OECD LEED Programme and the Dutch Ministry of Economic Affairs on Entrepreneurial Ecosystems and Growth Oriented Entrepreneurship The Hague, Netherlands.

Mason C and Brown R (2013b) Creating good public policy to support high growth firms. *Small Business Economics*. 40(2):211-225.

Mason C and Harrison R (2006) After the exit: Acquisitions, entrepreneurial recycling and regional economic development. *Regional Studies* 40(1):55–73.

Nambisan S and Baron RA (2013) Entrepreneurship in Innovation Ecosystems: Entrepreneurs' Self-Regulatory Processes and their Implications for New Venture Success. *Entrepreneurship, Theory and Practice*. 37(5):1071–1097.

Nelson RR (1959) The simple economics of basic scientific research. *Journal of Political Economy*. 49:279-306.

Nesta (2014) Making sense of the UK collaborative economy. Available at: http://www.nesta.org.uk/sites/default/files/making_sense_of_the_uk_collaborative_economy_14.pdf (Accessed 4 October 2016.)

Nightingale P and Coad A (2014) Muppets and gazelles: political and methodological biases in entrepreneurship research. *Industrial and Corporate Change*. 23(1):113-143

OECD (2010) The OECD Innovation Strategy: Getting a Head Start on Tomorrow. Paris: OECD. Available at: <http://www.oecd.org/sti/inno/theoecdinnovationstrategygettingaheadstartontomorrow.htm>. (Accessed 23 May 2016.)

OECD (2011a) Regions and Innovation Policy. Paris: OECD. Available at: <http://www.oecd.org/innovation/oecdreviews/regionalinnovationregionsandinnovationpolicy.htm>. (Accessed 23 May 2016.)

OECD (2011b) Demand-side Innovation Policies ISBN 978-92-64-09887-9. Available at: <http://www.oecd.org/sti/demand-sideinnovationpolicies.htm>. (Accessed 23 May 2016.)

OECD (2013) Innovation driven growth in the regions: The role of smart specialisation. Available at: <https://www.oecd.org/innovation/inno/smart-specialisation.pdf>. (Accessed 23 May 2016.)

Office for National Statistics (2015) Regional Gross Value Added (Income Approach). Available at: <http://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2015>

Office for National Statistics (2016a) Economic Review 2016. Available at: <http://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/articles/economicreview/august2016#investment> (accessed 4 October 2016.)

Office for national Statistics (2016b) Business Investment. Available at: <http://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/businessinvestment/quarter1jantomar2016revisedresults#main-points>.

Office for national Statistics (2016c) Quarterly Sector Accounts: Quarter 1 Jan to Mar 2016. Available at: <https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/articles/quarterlysectoraccounts/quarter1jantomar2016#net-lending-and-net-borrowing-by-sector>.

Riley R Rosazza-Bondibene C and Young G (2015) The UK productivity puzzle 2008–13: evidence from British businesses. Staff Working Paper No. 531. Bank of England. Available at: <http://www.bankofengland.co.uk/research/Documents/workingpapers/2015/swp531.pdf>.

Rigby DL and Essletzbichler J (2000) Impacts of Industry Mix, Technological Change, Selection and Plant Entry/Exit on Regional Productivity Growth. *Regional Studies*. 34(4):333-342.

Plumridge A Webber DJ Boddy M and Hudson J (2008) Country-level business performance and policy asymmetries in Great Britain. *International Journal of Business Performance Management*. 10(4):305-317. Available from: <http://eprints.uwe.ac.uk/15914>.

Porter M (2003) The Economic Performance of Regions. *Regional Studies*. 37(6-7):549-578,

Sarasvathy SD (2001) Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *Academy of Management Review*. 26(2):243–263.

Sarasvathy SD and Dew N (2005). New market creation through transformation. *Journal of Evolutionary Economics*. 15(5):533–565.

Scott A. and Storper M (2003) Regions, Globalization, Development. *Regional Studies*. 37 (6-7):579-593.

Scottish Government (2015) Scottish Economic Strategy 2015. Available at:
<http://www.gov.scot/Resource/0047/00472389.pdf>

Shane S (2009) Why encouraging more people to become entrepreneurs is bad public policy. *Small Business Economics*. 33(2):141–149.

Shane S and Venkataraman S (2000) The promise of entrepreneurship as a field of research. *Academy of Management Review*. 25(1): 217–226.

Skerratt S (2013) Localism: Identifying complexities and ways forward for research and practice. *Local Economy*. 28(3):237–239.

Skerratt S and Steiner A (2013) Working with communities -of-place: Complexities of empowerment. *Local Economy*. 28(3):320–338.

Sleigh A Stewart H and Stokes K (2015) Open Data Set Makerspaces, Nesta (2015). Available at:
http://www.nesta.org.uk/sites/default/files/open_dataset_of_uk_makerspaces_users_guide.pdf. (accessed 2 June 2016)

Smith K (2000) Innovation as a Systemic Phenomenon: Rethinking the Role of Policy. *Enterprise and Innovation Management Studies*. 1(1):73-102.

Stiglitz J (2012) The Economist. Available at: <http://www.economist.com/node/21547999>.

Stokes K Clarence E Anderson L Rinne A (2014) Making sense of the collaborative economy. Nesta. Available at: http://www.nesta.org.uk/sites/default/files/making_sense_of_the_uk_collaborative_economy_14.pdf.

Storey DJ (1994) Understanding the Small Business Sector. London: Routledge.

Storper M (1997) The regional world: Territorial development in a global economy. New York: Guilford Press.

Svare H and Haugen Gausdal A (2015) Strengthening regional innovation through network-based innovation brokering. *Entrepreneurship & Regional Development*. 27(9–10):619–643.

Talbot S (2015) Business Intelligence Briefing Paper No. 2 Crichton Institute July.

Technopolis 2012 The role of Technology and Technology-based Firms in Economic Development: Rethinking Innovation and Enterprise Policy in Scotland.

Coad A and Reid A (2012) The role of Technology and Technology-based Firms in Economic Development Rethinking Innovation and Enterprise Policy in Scotland. Technopolis Group. A report for Scottish Enterprise.

Available at:
<http://www.evaluationsonline.org.uk/evaluations/Browse.do?ui=browse&action=show&id=504&taxonomy=I>
[NO](#) (Accessed 23 May 2016)

Thompson P Jones-Evans D and Kwong C (2009) Women and home-based entrepreneurship: Evidence from the United Kingdom. *International Small Business Journal*. 27(2):227–239.

Trajtenberg M (2012) Can the Nelson-arrow paradigm still be the beacon of innovation policy? In: Lerner J and Stern S (Eds) *The Rate and Direction of Inventive Activity Revisited*. The University of Chicago Press, Chicago, IL
Chicago: University of Chicago Press, 679-684

Teubal M (1977) *Innovation Performance, Learning and Government Policy: Selected Essays*. Madison: University of Wisconsin Press.

Turner A (2012) Securitisation, shadow banking and the value of financialisation. Rostov lecture. Available at: <http://www.fsa.gov.uk/static/pubs/speeches/0419-at.pdf>.

von Hippel E (2005) Democratizing innovation: The evolving phenomenon of user innovation. *Journal Für Betriebswirtschaft*. 55(1):63-78.

Walker E (2003) Home-based businesses: Setting straight the urban myths. *Small Enterprise Research*. 11(2):35-48.

What Works Centre for Local Economic Growth (2014) Evidence Review: Business Advice, May 2014. Available at: <http://www.whatworksgrowth.org/policy-reviews/business-advice/>.

Webber DJ Boddy M and Plumridge A (2007) Explaining Spatial Variation in Business Performance in Great Britain. *The European Journal of Comparative Economics*. 4(2):319-332. Available at: <http://eaces.liuc.it/18242979200702/182429792007040208.pdf>

Woolthuis RK Lankhuizen M and Gilsing V (2005) A System Failure Framework for Innovation Policy Design. *Technovation*. 25(6):609-619.

Diagrams

Diagram 1: The Micro-sphere model

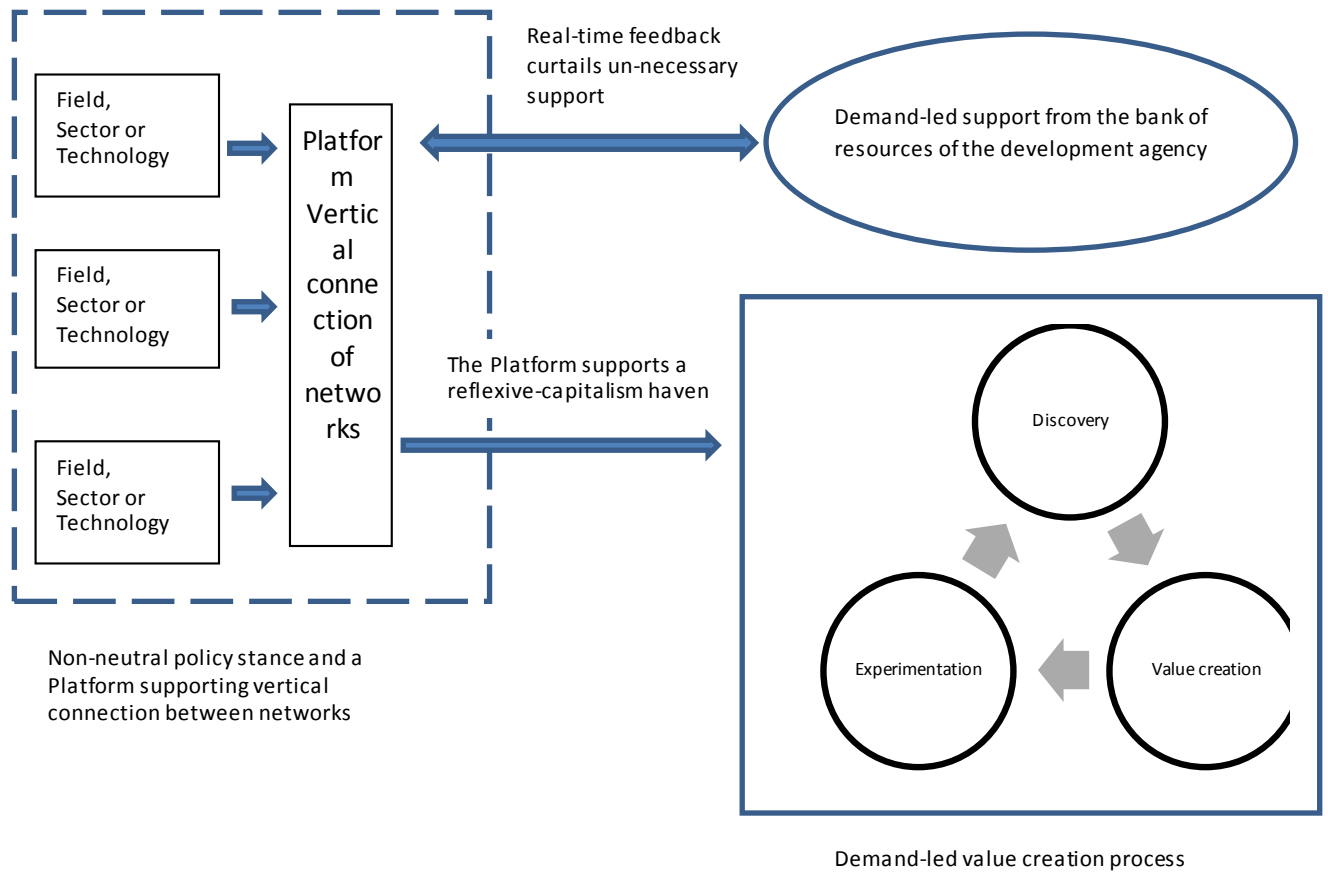


Diagram 2: The function of the Platform: enhancing the networking effect

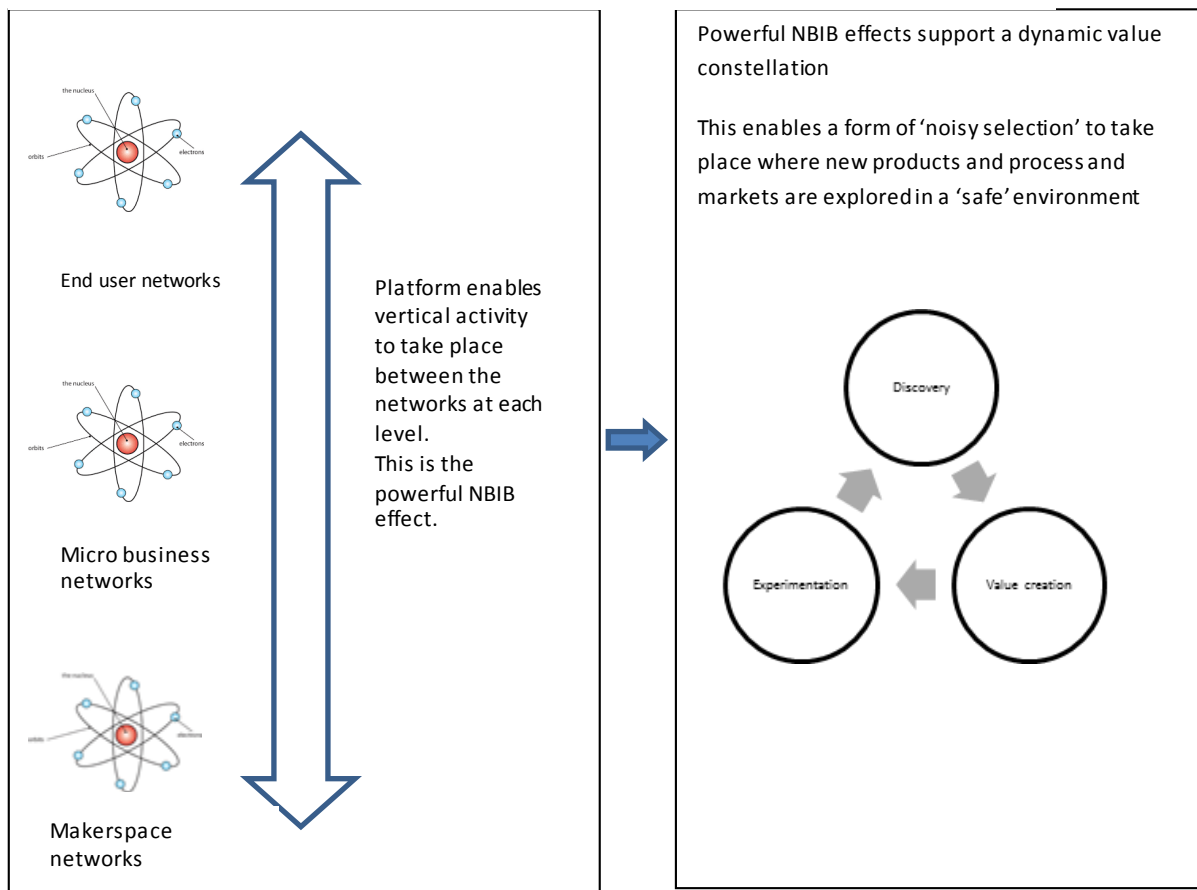


Diagram 3: The Micro-sphere model populated

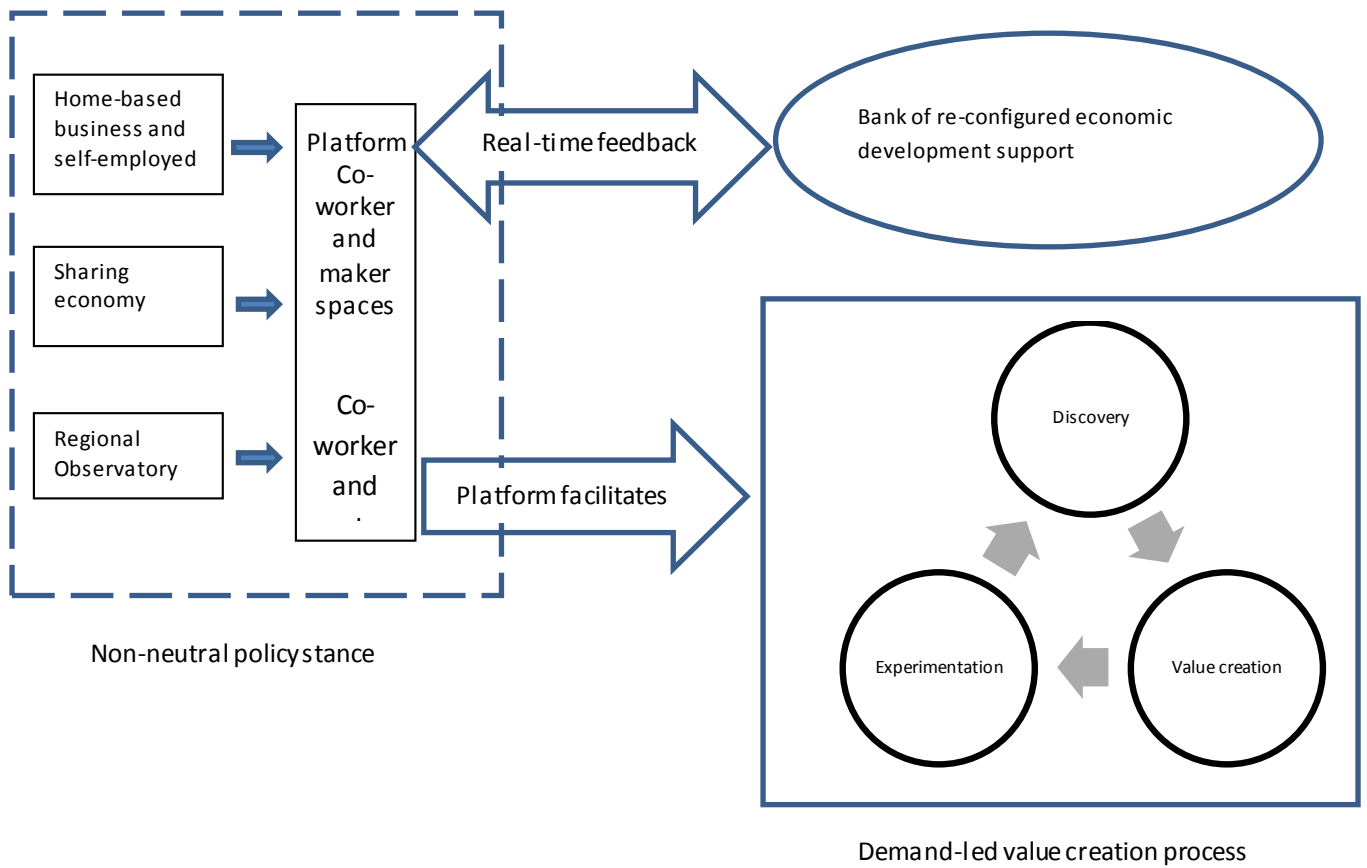


Diagram 4: Spectrum of engagement (examples of range of potential types of engagement)

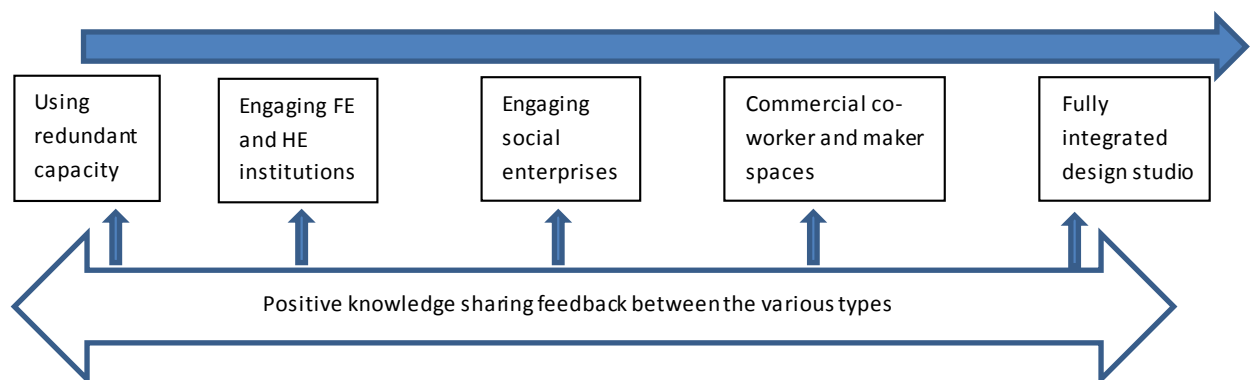


Diagram 5: Example of a demand-led policy framework

